MARS GRAVITY FIELD MODELING WITH MGS

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The first aerobraking phase (AB-1) of the Mars Global Surveyor (MGS) mission started after the Mars Orbit Insertion (MOI) on September 12, 1997, to the end of March 1998. During this period, no periapsis data were obtained because the spacecraft attitude prevented radio communication within ±30 minutes of periapsis. However, three months of periapsis tracking data have been collected during the two Science Phasing Orbit phases (SPO-1 and SPO-2 separated by one month of solar conjunction period). These data have periapsis altitude of 170 km with periapsis latitude varying from $65\deg$ N to $85\deg$ N and the orbital tracks spaced to provide good coverage in longitude.

The MGS tracking data will be incorporated with the historic tracking data of the Mariner 9, Viking Orbiter 1, and Viking Orbiter 2 to determine a 75th degree and order Mars gravity field model. Surface Acceleration A Priori (SAAP), derived from globally distributed constraint equations, will be used to constrain the gravity solution. Each constraint equation sets the surface radial gravity acceleration, contributed from the terms with harmonics degree greater than the local degree strength of the unconstrained solution, to zero. The degree strength of a gravity solution is the harmonic degree where error (noise) prediction from the formal error covariance is larger than the power (signal) prediction from the Kaula's rule.

The gravity solution using SAAP a priori, which provides constraints in the spatial domain, will be compared with the gravity solution using Kaula's a priori, which provides constraints in the spectral domain. The gravity anomaly maps over the various regions of the Mars surface will be investigated. Statistical comparison and orbit fit evaluation will be shown as well as the error predictions using the formal covariance of the gravity solution. The gravity anomalies and their correlation with the topography, derived from the Mars Orbiting Laser Altimeter (MOLA), and imaging, obtained from the Mars Orbiter Camera (MOC), will be displayed.